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ABSTRACT

This study investigated: (1) the effects of early mother-infant interaction on the infant's cognitive and social development during the first year of life; (2) the impact of perinatal factors on that development; and (3) the differences, if any, in the impact of mother-infant interaction and perinatal factors on preterm and full term infants. Subjects were 49 mothers and infants (26 preterms and 23 fullterms) from a low income black population. Perinatal optimality was assessed with a scale developed by Parmelee and his associates. Indices which characterize the structure of mother-infant interaction were derived from two observation sessions, one just before hospital discharge and one a month later. Development was defined as the change in Bayley Mental Development Indices (Corrected for conceptional age) from 3 to 12 months after hospital discharge. Results were interpreted as supporting the notion that preterms are generally more sensitive to environmental influences than fullterms. Data suggest that: (1) instead of being more critical for infants with a history of perinatal complications, mother-infant interaction may actually be less critical; and (2) intervention programs which would improve developmental outcome should focus on those factors which underlie perinatal complications. (Author/MS)

Perinatal Risk, Mother-Infant Interaction, and Early Developmental Outcome of Preterm and Fullterm Infants

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By way of introduction, let me say that I am a social psychologist interested in early mother-infant interaction. I am not a medical person and so I am more interested in how medical complications in general affect behavior than I am in particular medical problems.

A few years ago Josephine Brown and I began collecting data from preterm and fullterm infants and their mothers sampled from a low-income, inner-city, black population. We wanted to demonstrate the effect of the infant's initial biological condition on early mother-infant interaction, and further, the effect of early interaction on the infant's subsequent development. We also wanted to develop indices that would assess various qualities of mother-infant interaction, for example, the quality of "meshing" that Robert Hinde (see Hinde & Simpson, 1975) mentions.

Method

Subjects. Subjects were 32 preterm and 24 fullterm infants and their mothers; mean gestational ages were 32 and 40 weeks and mean birthweights were approximately 1600 and 3200 grams respectively. Excluded from the sample were preterms who weighed less than 1000g or who evidenced gross physical or neurological damage and fullterms who had substantial perinatal complications. During the first year, three preterms died and three mothers of preterms and one of a fullterm left the project, so the data reported here are based on 26 preterm and 23 fullterm mother-infant dyads.

Perinatal optimality. In addition to the distinction between pre- and fullterm, we gauged the infant's initial biological condition with a perinatal optimality score. We chose such a measure because Prechtl (1968) has demonstrated that the total number of perinatal complications, more than the particular complications, is predictive of early neurological status. The scale we used--which uses many of Prechtl's items--was developed by Bruce Littman of UCLA (see Parmelee, Kopp, & Sigman, 1976). It consists of 41 yes-no questions, for example: maternal age between 18 and 30? previous abortions? high blood pressure? bleeding during pregnancy? vertex delivery? resuscitation required? Apgar scores of 7 or better? etc. The items were answered from medical records and the score we assigned was the percentage of optimal responses so a mother-infant dyad who experienced no complications whatever would have received a score of 100%.

Mother-infant interaction/interactive predictability. The aspect of mother-infant interaction that is reported here I have termed interactive predictability. It gauges the orderliness, or patterning, or predictability of an interaction viewed as a whole and is derived from detailed observational records of mother-infant interaction by a two-step data reduction process. The result is a content-free index which we believe taps an underlying structural property of the dyadic interaction.

Observers recorded some 140 specific, detailed, concrete behaviors using an electronic digital recording device. Codes were designed so that the resultant data preserved frequency, duration, and co-occurrence information for all behaviors recorded. Forty-six of these detailed behaviors were designated "mother communicative acts" and 32 as "infant communicative acts." These included such behaviors as mother rocks, rubs,

pats, pokes, vocalizes, shifts position, offers bottle, etc., and infant cries, whines, babbles, burps, looks to mother, smiles, wiggles, waves arm, rejects nipple, etc.

For the first stage of data reduction we segmented the observed stream of behavior into five-second intervals and then categorized each interval as containing no communicative acts at all, only some mother communicative act or acts, only some infant communicative act or acts, or both mother and infant communicative acts. Thus there are four possible categories or dyadic states. If these dyadic states were labeled "1", "2", "3", and "4" then an entire half-hour observation session would be reduced to a sequence of these states, e.g., 11124433332221111... etc.

For the second stage of data reduction we used a measure defined by information theory. This measure--which I call interactive predictability and which those of you familiar with information theory will recognize as stereotypy--is not concerned with particular dyadic states or even with particular patterns of dyadic states but instead gauges the average level of patterning, or orderliness, or predictability of an entire sequence. In theory this index can vary from zero to one; a value of zero indicates complete sequential randomness while higher values indicate increasing predictability.

Mothers and infants were observed three times, just before hospital discharge, one month later, and three months later, so we could compute three different predictability scores. Actually, for these analyses we are using the interactive predictability score derived from the three-month observation. At that time infants were more active than previously and thus contributed more to the interaction, and mother and infant had

had time to become accustomed to each other and to establish an interactive style.

Mental development. To summarize, the three measures are: a perinatal optimality score, a measure of interactive predictability, and a Bayley Mental Development Index score, administered 12-months after hospital discharge and corrected for conceptional age. The mean values for pre- and fullterms did not differ for the Bayley or for the interactive predictability score but did for the optimality score. In fact, only 4 fullterms scored below 85% while only 1 preterm scored above that value.

Results

We had expected that perinatal optimality would affect interactive predictability, at least for the preterms who, it is sometimes argued, are more sensitive to environmental influence. But this was not the case. For both pre- and fullterms the correlations between optimality and interactive predictability, although positive, were small and insignificant.

When Bayley scores were predicted from perinatal optimality and interactive predictability, separately for pre- and fullterms, the resultant equations accounted for 23% and 17% of the variability in Bayley scores respectively. In the case of the preterms, perinatal optimality accounted for almost all of the variability--22 out of 23%--so that the additional contribution of interactive predictability was essentially negligible. In the case of the fullterms, interactive predictability accounted for much of the variability--13 out of 17%--but the equation failed to reach conventional levels of significance (see Table 1).

Let me restate the results. Fullterms had few perinatal complications and the number of complications predicted neither interactive predictability

nor 12-month Bayley scores. There was a modest relationship between predictability and mental development, significant at the .10 but not the .05 level. Preterms, on the other hand, had several perinatal complictions and the number of complications predicted 12-month Bayley scores. There was essentially no relationship between number of complications and predictability or between predictability and mental development.

Discussion. In conclusion, I would like to make three points. First, a cummulative risk or optimality score--as suggested by Prechtl and Parmalee--is useful in predicting developmental outcome, but only for infants with a history of several complications (see also Goldstein, Caputo, & Taub, 1976). When the number of complications was less than 5--that is, when the optimality score was greater than 85%--we found no correlation between perinatal optimality and the Bayley. In fact, this correlation was .004, while for those infants with optimality scores of 85% or less, the correlation was .510.

Second, I am considerably less enthusiastic and optimistic now than I was two years ago about the possibility of defining an objective measure of interaction that both taps important qualities of the dyadic interaction and relates to other important aspects of the infant's life, like developmental outcome. In addition to interactive predictability, we have examined several other measures of mother-infant interaction, and the general pattern is the same: while we usually find group differences, suggesting that the infant's initial condition does affect interaction, we find little evidence that interaction style affects subsequent development, at least within the first year of life.

In the present case, the regression lines for Bayley scores as predicted by interactive predictability were almost identical for the pre- and

full-term samples, which suggests that the relationship between these two variables is the same for both groups of infants. But that relationship, if it indeed exists, is practically unimportant. Among fullterms it only accounts for 13% of the variability in Bayley scores while among preterms, the little bit of variance it does account for is overwhelmed by perinatal complications. Contrary to some current speculation, these data suggest that mother-infant interaction, instead of being more critical for infants with a history of perinatal complications, may actually be less critical (for evidence to the contrary see Beckwith, Cohen, Kopp, Parmalee, & Marcy, 1976). It may be that mother-infant interaction becomes important only for relatively healthy babies. In any case, the strongest predictor we have found for early developmental outcome is simply the number of perinatal complications.

Finally, the practical conclusion we draw from these data is that intervention programs which would improve developmental outcome should focus on those factors which underlie perinatal complications. Ultimately, this may turn out to be more of a political than a medical problem.

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Table 1

Optimality, Interactive Predictability, and Mental Development Indices: Correlation and Regression Coefficients

	prematures (N = 26)		fullterms (N = 23)		all dyads (N = 49)	
	OCS	IPI	OCS	IPI	OCS	IPI
IPI	.421	1.	.131	1.	.168	1.
MDI	.468*	.226	.245	.357+	.325*	.286*
β	.438*	.120	.202	.330	.285*	.238*
R^2	.233		.167		.161	
F	3.48*		2.01		4.41*	

Note: Significance for Pearson product-moment correlations is two-tailed.

+ $p < .10$

* $p < .05$